Testing the Future Force — A Transformation in Testing

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The test and evaluation (T&E) plan for Future Combat Systems (FCS) is unique and has four main components as follows:

- An evaluation strategy covering platform and individual systems to system-of-systems (SoS). It is based on decomposition of SoS missions to individual component capabilities and technical specifications.
- A test plan that is a highly integrated combination of modeling and simulation (M&S) and live, technical, operational and contractor and government testing.
- A highly capable and distributed SoS Integration Laboratory (SOSIL).
- All of the above are planned and will be directed and managed by a Combined Test Organization.

FCS is a family of advanced, networked air- and ground-based maneuver, maneuver support and sustainment systems. These systems are networked via a command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) architecture operating as an SoS that will network existing systems, systems already under development and new systems to meet the unit of action's (UA's) needs. The effectiveness, suitability and survivability of the FCS Family-of-Systems (FoS) and the SoS should exceed the sum of the capabilities of the individual systems. Therefore, FCS test and evaluation is based on an integrated plan that builds from individual system testing through SoS testing.

FCS operational testing will be conducted in the context of a UA operating in a field environment against a realistic OPFOR and per the O&O plan. The FCS evaluation will support the whole range of acquisition actions and decisions.

Evaluating FCS is unique because of its magnitude and scope and because it must address the capabilities of the individual FCS and the FCS FoS, as well as FCS contributions and their complementary systems to UA mission performance. In the great majority of acquisitions, the Army is only adding or replacing an individual system to an existing unit structure. In this case, the UA is being developed at the same time as its equipment. As always, FCS operational testing will be conducted in the context of a UA operating in a field environment against a realistic opposing force (OPFOR) and per the operational and organizational (O&O) plan. The FCS evaluation will support the whole range of acquisition actions and decisions.

The evaluation strategy for assessing FCS effectiveness, survivability and suitability (ESS) FoS is based on mission accomplishment. The strategy is underpinned by tracing how missions are decomposed into tasks that are enabled by capabilities that are provided by the materiel. ESS evaluation involves discerning whether the materiel is sufficient to enable completion of mission-critical tasks when set upon by elements within the operational environment such as the threat, terrain and weather. Underpinning the evaluation strategy with mission decomposition enables early detection of "gaps" in:

- FCS FoS capabilities.
- Identification of design attributes that should be sufficiently robust to enable performance in spite of a degraded state.
- Reinforcement of Manpower Personnel Integration considerations.

During the early stages of system development and demonstration (SDD), the continuous evaluation will primarily be enabled through M&S. As the program matures, these same M&S representations will be leveraged to support and interface with hardware technical and operational testing to provide data to support M&S verification and validation and to support the evaluation.

The FCS T&E plan is highly integrated in four ways. First, the FCS SoS is an integration of multiple systems. The acquisition and testing strategies are centered around the development of these individual systems and concurrent integration of them into an SoS.
The test plan is composed of seven integration and testing phases. These phases start with detailed designs and models (IP S1), through components and

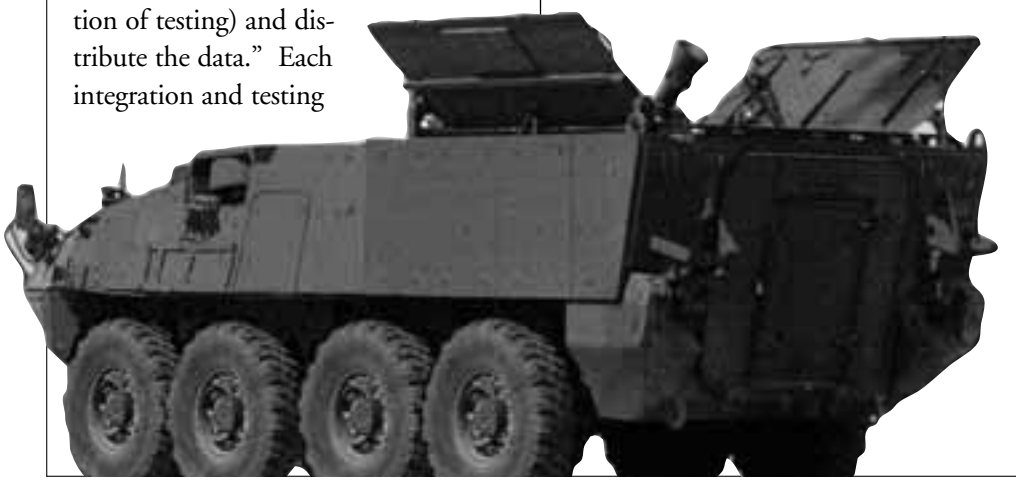
system-level models (IP S2), hardware prototypes (IP S3 and S4) and finally with production hardware (IP P1 and P2).

The second form of integration is synthetic (M&S) and live testing. A contiguous thread of M&S augmentation and support will be maintained throughout all testing. These M&S include representations of components, systems, forces (UA, unit of employment, Joint and opposing) and threats; scenario generators; environment simulators; synthetic stimuli and event controllers. These M&S will serve as input or nodes on the Systems Integration Laboratories (SILs) and SoSIL and wrap-arounds or players in Limited User Tests (LUTs), Force Development Test and Experiments (FDTEs) and the Initial Operational Test (IOT). Technical testing will use M&S to augment testing and will provide live data to support M&S verification and validation. A widely distributed synthetic environment known as the SoS Virtual Framework (SVF) will provide the SoSIL backbone to ensure that all connected simulations, models, emulations and hardware are stimulated and interact in a common environment.

The third way that FCS testing embodies integration is by integrating contractor and government testing throughout the entire acquisition. Every attempt has been made to "plan together, test once (meaning no duplication of testing) and distribute the data." Each integration and testing phase, as well as the technical field tests, involves jointly planned testing by the contractor and the government to examine SoS performance and system integration issues. An Integrated Qualification Testing (IQT) period is also planned. During this testing, system contractors will be conducting systems engineering verification testing to ensure that their designs and development prototypes meet the technical specifications.

Because this testing is often duplicative of Government Production Qualification Testing, integrated planning will ensure that this testing is conducted only once during this period. Integrated planning will also ensure that data used to verify specification compliance will feed the government's independent evaluation to support the Initial Production Decision (IPD). This same logic is used in planning an Integrated Verification Testing (IVT) of the initial hardware production as it is delivered to ensure that the manufactured hardware conforms to the accepted designs tested and evaluated during SDD.

Fourth, this test planning provides a strategy for technical and operational testing integration whenever and wherever appropriate. It is based on the assumption that Soldiers will be committed to FCS development and that a unit, when designated, becomes involved in all appropriate aspects of the combat development and acquisition processes at the appropriate time and place. This involvement includes being available to bring operational flavor to testing at appropriate opportunities and fully support the LUTs and IOT. Thus, Soldiers will conduct early user testing during the integration testing phases in the SoSIL by participating in user test (UT) scenarios that are oriented toward UA level and will eventually be accomplished in the IOT. This same integration will be accomplished as Soldiers are involved in the technical field tests and in the IQT and IVT.



Integrated testing will afford multiple opportunities to address many operational issues early and with a greater variety of environments and stimuli than the LUTs and IOT. The planned LUTs will be Army/Army Test and Evaluation Command controlled events with the primary purpose of addressing operational issues in realistic operational environments. Embedded instrumentation will capture additional technical test data, such as reliability, availability and maintainability, during all operational test events without hindering operational realism.

The testing and evaluation strategy is also based on an evolution of user and operational testing. Three LUTs will provide opportunities to test the FCS with increasing numbers of hardware prototype system assets and, finally, production hardware, in increasingly complex operational environments and scenarios that are structured toward UA employment as will eventually be executed during the IOT. The third LUT is configured to demonstrate — along with a proposed Army Certification Exercise (CERTEX) — Initial Operational Capability (IOC). An FDTE

The Stryker family of vehicles were designed to increase combatant commanders' mobility, lethality and battlefield survivability through networked battle command, long-range acquisition and targeting, and degradation of enemy detection and targeting capabilities.

is also planned following delivery of production hardware to provide an opportunity to refine and test the tactics, techniques, procedures and training prior to the IOT. Finally, the IOT is planned involving an FCS-equipped UA so as to properly represent the performance of this SoS-enabled, fully integrated unit in a selection of live operational environments and scenarios. These environments and scenarios are chosen so that they represent the most likely, and include some of the most stressful and unique missions, of those specified in the FCS O&O Plan. The IOT, along with another proposed Army CERTEX, will be used to demonstrate full operational capability (FOC) and support a full-rate production (FRP) decision. M&S will be used to expand the evaluation beyond the chosen scenarios.

The overall FCS survivability in the UA context will be a function of more than traditional ballistic and nonballistic individual platform vulnerability and susceptibility. The holistic survivability capabilities will be determined in terms of active and passive capabilities to see the enemy, maneuver out of contact and destroy the enemy at extended ranges or in close contact on our terms. The cornerstone enabling capabilities for survivability include networked battle command, integration of signature management, active and passive protection systems, Land Warrior, early and long-range acquisition and targeting, network lethality, obscurants, dash speed and degradation of enemy detection and targeting.

UA survivability is dependent on C4ISR as well as the munitions defeat mechanisms on the hardware systems. Therefore, significant information assurance and network stability, reliability and functionality testing are planned as part of the SIL and SoSIL as well as during technical field testing, LUTs, FDTE and IOT, to feed the effectiveness evaluation and survivability evaluation. The plan incorporates Title X Live Fire Test (LFT) within the survivability attachment because it contributes significantly to the ballistic vulnerability evaluation. LFT is applicable only to covered systems, which in FCS's case, are the manned ground systems. However, survivability testing and evaluation will be conducted on all systems and the SoS.

Finally, this plan has been developed by, and will be directed and managed by, a Combined Test Organization. This is an equal partnership of the FCS Program Management Office (PMO), Army Test and Evaluation Command, and Lead Systems Integrator (LSI) personnel. The organization supplants the traditional PMO test management and augments the ATEC and LSI top-level test management. Its goal is the most efficient testing through integration, combination and sharing. Integration has been described in detail previously. Test resources will be combined for time and cost efficiency and data will be shared completely. This organization will also see that developmental and operational testing are integrated as much as appropriate while still preserving the Title X specified independence. The Combined Test Organization's motto is: plan together, test once and share the data.

FCS is a cornerstone of Army transformation. It will be a unique capability that will be deployed and will function in nontraditional ways. The program management is unique because it must deliver an FoS, and an FCS-equipped unit as well. A unique T&E plan has been developed to ensure that requirements are being met as prescribed. As the Army transforms, so too must T&E.

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